

Development of an Exploration-Class Cascade Distillation System: Flight Like Prototype Preliminary Design

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The ability to recover and purify water through physiochemical processes is crucial for realizing long-term human space missions, including both planetary habitation and space travel. Because of their robust nature, distillation systems have been actively pursued as one of the technologies for water recovery. One such technology is the Cascade Distillation System (CDS) a multi-stage vacuum rotary distiller system designed to recover water in a microgravity environment. Its rotating cascading distiller operates similarly to the state of the art (SOA) vapor compressor distiller (VCD), but its control scheme and ancillary components are judged to be straightforward and simpler to implement into a successful design. Through the Advanced Exploration Systems (AES) Life Support Systems (LSS) Project, the NASA Johnson Space Center (JSC) in collaboration with Honeywell International is developing a second generation flight forward prototype (CDS 2.0). The key objectives for the CDS 2.0 design task is to provide a flight forward ground prototype that demonstrates improvements over the SOA system in the areas of increased reliability and robustness, and reduced mass, power and volume. It will also incorporate exploration-class automation. The products of this task are a preliminary flight system design and a high fidelity prototype of an exploration class CDS. These products will inform the design and development of the third generation CDS which is targeted for on-orbit DTO. This paper details the preliminary design of the CDS 2.0.

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